# Report of the

# TWENTY-FOURTH SOUTHERN PASTURE AND FORAGE CROP IMPROVEMENT CONFERENCE

Louisiana State University
Baton Rouge, Louisiana

April 11-12, 1967



UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Crops Research Division

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# TWENTY-FOURTH SOUTHERN PASTURE AND FORAGE CROP IMPROVEMENT CONFERENCE[1/]

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## PROGRAM

Tuesday - April 11 - Morning
Pleasant Hall, Room 148
Chairman H. A. Fribourg, University of Tennessee, Presiding



1/ Reported by: R. C. Leffel, Permanent Secretary, USDA, Beltsville, Maryland.

Tuesday - April 11 - Afternoon

I. Animal Interest Section and Southern Forage Ecology and Physiology Group - John E. Moore, University of Florida, Presiding - Room 148, Pleasant Hall



II. Forage Breeders' Interest Group - M. S. Offutt, University of Arkansas, Presiding - Room 154, Pleasant Hall



Tuesday - April 11 - Evening

7:00 Banquet - Student Union Royal Ball Room - Speaker - Mr. Justin Wilson - "Stories and Philosophy of the Acadian French People of Louisiana"

Wednesday - April 12 - Morning

Research Tour, Southeast Louisiana Branch Experiment Station, Franklinton, Louisiana

Conference adjourned at conclusion of tour at Franklinton, Louisiana

Tuesday - April 11, 1967 - Morning

Henry A. Fribourg, Presiding

Opening Session

The twenty-fourth meeting of the Southern Pasture and Forage Crop Improvement Conference was opened by Conference Chairman Henry A. Fribourg. The Invocation was given by The Reverend Mr. M. C. Cady. Chairman Fribourg announced a Conference registration of 98, and introduced all present by State, government agency, and industry.

Welcome by Agronomy Department - W. H. Willis, Head, Department of Agronomy, Louisiana State University.

The 25 members of the research and teaching faculty of the Agronomy Department join me in extending to each of you a most cordial welcome to Louisiana State University and to this Conference.

We wish that more of you had brought the ladies. The ladies of the Agronomy Department have prepared entertainment for those ladies who accompanied you to the Conference.

Corbin Owen, Clifford Mondart, Jr., and Bill Monroe have served as your local arrangements committee for this Conference. The amount of work done by your program committee and by each of those who have participated on the program became obvious from the high caliber of the reports that we heard yesterday on the genetics, breeding, physiology, ecology, quality, management and utilization of forage crops and on biologically-fixed versus industrially-fixed nitrogen.

The extremely important problems of maximum pasture utilization and seed production and distribution beyond the breeder's level are to be covered in symposia this afternoon.

Much research has been done. Much remains to be done. With total cash receipts from farm products in Louisiana exceeding 500 million dollars and the income from livestock and livestock products accounting for 32% of this, the increasing importance of good pastures and quality forage is apparent.

We have 3,700,000 acres in open pasture in Louisiana. The acreage has increased sharply during the last 10 years. But most of this is not improved pasture. Much of the land in upland pastures has been badly eroded. Much of that in the floodplains needs drainage. Much of the pasture acreage needs lime; most requires phosphate and potash. All need nitrogen. And there may be other nutrient-element needs that we do not yet know about. Much seeding to adapted species must be done.

But the production of choice grade 900 to 1000-pound steers on good pastures and then 100 days on mature corn silage, with oats, urea and limestone added, is now a profitable reality in Louisiana.

And tomorrow, at the S. E. La. Experiment Station at Franklinton, you will have an opportunity to see the great progress being made in production of high quality pastures and forages for dairy cattle. We are sure that your visit there will be profitable and enjoyable. You will find Mr. Ellzey and his staff to be very gracious hosts.

We hope your brief visit with us is both enlightening and enjoyable. Please let us know if there is anything we might do to help make it so.

<u>L.S.U. - Louisiana's Land Grant Institution</u> - John A. Hunter, President, Louisiana State University

On behalf of Louisiana State University I want to extend to each of you a most cordial welcome to our campus. It has been quite a few years now since those of us at LSU had the privilege to serve as hosts for this Conference and we welcome the opportunity to greet you once again.

As president of a university that has long been committed to the continued development of agriculture, I am very much aware of the vital contributions that specialists such as you are making to the well being of our region, our nation and, indeed, the world.

To be sure, you represent what I often refer to as one of the most ingenious, and most productive, segments of society today. I never cease to be amazed whenever I review the truly remarkable achievements that agricultural specialists such as you have helped to make possible in years past. Agricultural advancement during this century stands as the unparalleled success story of American technology rising to meet one of the greatest challenges facing mankind. And, I would remind you, that this success story is as uniquely American as apple pie and crawfish gumbo. It is a success story that has been neither matched, nor approached, by any other nation of the world.

In fact, I was reading just the other day some revealing statistics concerning agricultural production. Take Soviet Russia for example. While Russia's total farmland is equal to the combined crop area of both the United States <u>and</u> Canada, the Soviet Union produces only about three-fourths as much farm goods as does the United States. Thus, with considerably less available land, Americans are producing far more than their Russian counterparts.

The reasons why, of course, are many--both sociological and technological. One of the most important reasons, however, is based upon a single idea, an idea that is little more than a hundred years old. That idea is the land-grant concept of American education, an idea that recognizes the unique potential of the individual and emphasizes in a practical way the pursuit of the "agricultural and mechanic arts."

William Gladstone, one of the outstanding British statesmen of the 19th century, once wrote that the United States Constitution ranks as the greatest document ever struck by the hand of man. I agree one hundred percent.

And I also believe that the Land-Grant Act of 1862 ranks as one of the most significant steps forward in the history of American education. For through that Act, this university, along with 67 other institutions of learning throughout the nation, were established as practical centers of knowledge, dedicated to developing the common man into the uncommon man and pledged to come to grips with the basic problems facing mankind.

My assigned topic for this morning is LSU As Louisiana's Land-Grant Institution. Using LSU as one example among many, I would like to review with you some of the responsibilities--and achievements--that a commitment to the land-grant concept of education has inspired. I might point out that the institutions you represent share similar goals, similar hopes and, indeed, have achieved similar successes as land-grant institutions wholly committed to the interests of the people they serve.

Like those of the institutions you represent, LSU's educational responsibilities are unique because of the unique character of the land-grant idea. As a land-grant institution, LSU's responsibilities must be considerably broader, its services more far-reaching and its interests more diverse than any other kind of center of learning. This is the basic design of the land-grant college or university.

First and foremost, of course, in the mission of the modern land-grant institution is the responsibility to educate the individual. In the case of the combined land-grant college and state university such as LSU, there is a responsibility to educate in substantial numbers, literally thousands of individual citizens. As you may know, the open door policy is in effect at LSU today, a policy whereby the University accepts into its student body any high school graduate of this state who has the desire to seek a college education. This, I firmly believe, is in keeping with the basic land-grant tradition of making education available to all who desire it.

This open door policy has been responsible this year for attracting to LSU's four campuses more than 25,000 students. It is a policy that during the University's 107-year history has enabled LSU to award almost 60,000 degrees, representing virtually every field of human endeavor.

The resulting benefits to Louisiana-- and to our nation--of course, have been incalculable. The impact of these 60,000 trained, educated citizens upon the economic, social and cultural level of the South cannot be measured. Suffice it to say that as a land-grant institution, LSU's responsibility to educate in large numbers the young men and women necessary to sustain our region in the years ahead will be a continuing thing.

A second aspect of LSU's responsibility as a land-grant institution is an increasing emphasis upon research. Research, it has been said, is what makes the world go 'round, particularly during these times of scientific and technological change. It was not too many years ago that the average university devoted only a minimal portion of its time and its resources to research activities designed to push back the frontiers of knowledge.

No longer is this the case. The modern university--particularly the land-grant institution--has an irrevocable obligation to aggressively seek new truths, new ideas, new applications, new solutions to the critical problems of our time. As a matter of fact, I believe that in this age of discovery and innovation, the research function of the land-grant institution closely parallels that of teaching. For in these unusual times the institution that fails to make an organized effort to expand man's storehouse of knowledge is defaulting in its commitment to the future.

At the present time there are in progress at this university some 800 specific research projects, each of which represents potentially rich benefits to the citizens of this state. I am sure I don't have to remind you that over the years no area has benefitted more from such a program of research than agriculture itself. In fact, I would venture to say that of all the many outstanding contributions of the land-grant idea to the American scene, none surpasses the contribution that has been made to agricultural progress.

But important as is may be, agriculture represents only one area of the land-grant institution's research effort. In reality, this research effort touches, either directly or indirectly, virtually every phase of modern life. For example, here at LSU we study the oceans and the stars. We analyze human behavior, economic trends and social forces. We are probing the mysteries of nuclear science. We are working to develop plumbing systems for space capsules. We are studying the brain waves of infants to better understand how the human brain matures.

Problems of air and water polution, and the increasing dilemmas arising from urban living are typical of the newer fields in which research is being concentrated.

All of this implies an even more challenging task in the future, not only for research people, but for extension personnel who already have performed yeoman service in communicating to the grass roots the practical results of a concerted research effort.

What, then, are the prospects for the future of the land-grant institutions and their commitments to agriculture? More specifically, what are the major challenges that must be faced--and dealt with?

A hundred years ago, agriculturists at our land-grant institutions could restrict their objectives to the immediate future and to the distant horizon. Today, however, we must look far into the future, at least to the turn of the century, and we must concern ourselves with the agricultural needs of a hungry world.

I saw recently some pertinent facts and figures compiled by the Food and Agriculture Organization which, I believe, are as authoritative as any we might find. According to those figures, during the period in which I speak to you this morning approximately 500 people throughout the world will die of malnutrition, about 28 every minute. Of the 3.4 billion people in the world today, about half go to bed hungry every night.

Furthermore, demographers predict that by the year 2000 the world's population will reach 7 billion. And what will be required to feed them? If the world is to feed 7 billion people by the end of this century, it is estimated that the world's food supply must be increased five-fold, or an average of 4.8 percent annually.

The primary catalyst in this drive to feed the world, of course, will be the United States, utilizing to the maximum all of the agricultural technology, ingenuity and knowledge at its command. This focuses the spotlight squarely upon the land-grant college and university, and upon experts of proven ability such as you.

Whenever we look back upon past achievements of the land-grant institution, we cannot help but be awed by the progress that has been made in educating our youth, in maintaining high-level programs of productive research and in communicating these products of research to the people who can put them to use. But in light of the growing needs of these unusual times, the past is merely a prelude to what the future must bring.

If I may draw a parallel, land-grant institutions occupy a position much like that in which Harry Houdini, the world-famed magician of another generation, found himself. Despite his near-legendary reputation as a performer of miracles, Houdini found it necessary to continue to devise newer, bolder and even more dazzling feats of legerdemain in order to satisfy his audiences. During the years ahead, the land grant college and university, too, must continue to perform even more miraculous feats in order to satisfy the needs of our time--in educating two students tomorrow where we educated only one today, in making two blades of grass grow where today there is only one, in transforming original ideas into tangible human progress.

Through each of these there runs a single thread--an overwhelming responsibility on the part of the land-grant institution to come to grips with the future, to anticipate the educational needs of our region 10, 20, even 30 years from now, to foresee and plan effectively for the changing needs of a changing region during the challenging decades ahead.

For, in the final analysis, that is what modern education is all about--change, practical change made possible through greater knowledge, constant change that elevates man above his environment and creates for every citizen a better life.

Obviously, the character of the land-grant college is changing, just as the world around us is changing. Educational horizons are rapidly being extended, just as the physical horizons of space are swiftly being pushed back. But the overall mission remains the same--to serve the needs of citizens from every walk of life, to effectively bridge the gap between yesterday's remarkable story of progress and tomorrow's challenging chronicle of promise.

Louisiana Agriculture - John A. Cox, Director, Louisiana Cooperative Extension Service.

I have been asked to discuss the general agricultural situation in Louisiana, a task that is somewhat complicated by the changes taking place in the state's economic structure. The agricultural picture is further complicated by the state, national and world affairs that affect the farmer today more than ever before in history.

If any of you have had a child born in the past few months, you might pause to reflect that, by the time he is 33 years old, the population of the entire world will be about double what it is today. Where will that child be getting his food supply? What will be the source of foodstuffs that we take for granted?

Within this next 33 years we will be faced, not only with an increasing number of people, but also a diminishing amount of new land available for food production.

During the past week, most of us consumed at least 7 eggs and 10 pounds of meat and fish. More than half of the world's population has not consumed 7 eggs and 10 pounds of meat and fish in the last year. In more than half of the world, fertile land is too scarce to produce livestock and grain crops for feed, and all human food must be of the cereal and bean type.

We are helping many of these areas through our "Food for Peace" program, but that can't go on indefinitely. Problems being faced by many of these countries soon will be faced by us as we continue to lose our land to urban development, new highway construction and other land uses. Much of our better land already has been lost to such uses. Knowledgeable men are predicting that, to meet the needs of a populous world, food production in the year 2000 will have to be four times what it is today.

To get this problem down to Louisiana, various factors have changed the picture of the state's economy from one that depended on products of the soil to one that is increasingly dependent on the revenue from products of manufacturing and processing. I don't mean to say that agriculture is out of the picture because the total output of Louisiana farms continues to increase. The proportion has just changed.

In 1964 in Louisiana there were more than 5 million acres of land being farmed on 62 thousand farms. More than 2.6 million acres of this was devoted to cropland and 1.7 million were for pasture. Slightly more than 450,000 were devoted to cropland not harvested or used for pastures.

But the big story in land use in Louisiana is that 400 thousand acres were cleared in 1965 and 1966. Of course all of you know how most of that land is to be used (soybeans).

Since the well-being of the Louisiana farmer is determined to a large extent by market prices over which he has no control, what happens to the national agricultural market will, to a large degree, determine the future economic position of persons on farms in Louisiana. National policy toward price supports and acreage controls in agriculture probably will be the most important single determinant of farm income.

All of us realize that the economy is operating at an all-time high, but there is a downward trend in agricultural resources. The average income of farmers in the United States is between $2,500 and $3,400 per year--a figure significantly lower than the average wage received by industrial workers, and farm workers continue to flow to urban areas where better paying jobs are available.

Louisiana farm workers have been leaving for urban areas at a rate in excess of the national average. Contrary to some thinking, this trend seems to strengthen rather than weaken the Louisiana agricultural economy.

A careful analysis of the farm situation in Louisiana reveals this optimistic, rather than a pessimistic picture. With the decrease in the number of farms, the average size of the farm has increased. These large farming units make mechanization more economical and encourage the use of scientific agriculture. With the expanding total agricultural output divided among fewer persons, the income of these people who remain on the farm increases. There is good evidence that the commercial farmers are well off today. The squeeze is among the low income groups who are underemployed in agriculture.

While the average size per farm in Louisiana continues to be less than half the average size for the nation, the average size farm in the state grew at a more rapid rate from 1954 through 1964 than was true for the average of the nation.

Recent practices in clearing of new land and crop rotation systems are bringing in additional land for cultivation. Most of this cultivatible land is being devoted to expanding crop enterprises such as soybeans, with some going into pasture.

The relative importance of crop and livestock production in Louisiana's economy has been about 60 percent income from crops and 40 percent from livestock and livestock products. With present conditions prevailing, there is little indication that this ratio will change greatly. There may be some slight indication that income from livestock could increase, particularly in some sections of the state.

Regardless of government programs and present trends in planted acreages, it is believed that average yields of crops in the state will continue to increase, resulting in more overall production. This, with reasonable prices, will result in more income to Louisiana farmers.

The climate and rate of growth of vegetation offer advantages to livestock producers in this state. Increasing urbanization in the state

should continue to provide an expanding market for livestock products of all types. The fact that livestock enterprises have been able to maintain a relatively favorable position in the overall economy without the aid of price support and production restrictions gives these enterprises a much brighter outlook for the future than is the case for other farm products. With increased quality of livestock, better management practices and increased demands for livestock and livestock products, Louisiana producers will continue to be in a favorable position.

Agricultural production in Louisiana centers mainly around cotton, soybeans, rice, livestock, sugarcane and forest products. Forests and forest products lead the state in number of acres as well as income, but that is attributed to commercial forests, not necessarily farm production.

Going by strict farm production, rice is the biggest money crop in the state, followed by sugarcane, then soybeans, then cotton. On the other hand, soybeans in 1966 accounted for the use of the most cultivatable land. Cotton was second, followed by rice and sugarcane.

As you readily see, cotton is no longer king in Louisiana, neither in acreage nor cash farm income. I don't know how beef cattle production fits into this picture as the 1966 figures are not yet available.

Other crops grown in this state include sweet potatoes, strawberries, peaches, pecans, peppers and various truck crops that are suitable for a small family farm operation. All of these are important in their own right, but they do not represent quite as large a segment of the land area used nor income as do those crops I mentioned earlier.

Pasture production, an area of interest to you, is of importance to 61 parishes in Louisiana. With present cow numbers, land is not a limiting factor on a state-wide basis. However, much of this land is now being used for soybean production. Even more is likely to be used during the next few years if soybeans remain in as favorable position as they are at present.

In our state, soil fertility is one of the limiting factors of pasture production. In 1959, some 10,000 cattlemen--22 percent of the state's total--used fertilizer on some 400 thousand acres of pasture. This means almost 7 percent of the pasture land was fertilized. In 1964, the number using fertilizer had increased to more than 14,000 and acres fertilized to 543,000--not a really significant increase.

Lime is badly needed on most pastures outside of the alluvial area in Louisiana. It is difficult to tell just how much is needed because census data is gathered in a particular year and farmers make a practice of fertilizing every other year.

Hay and silage production is a limiting factor in economical production, but the situation is not as critical as it has been in the past. Silage production is also on an upward trend. The yield of forage per acre of pasture varies to such an extent that it is almost impossible to give average yield data. Some pastures produce as low as 50 pounds of beef per

The entire amount of land for grazing purposes in the state remains fairly constant. However, the amount in any degree of improvement is influenced by many factors. During times of favorable prices for livestock, more acres are in stages of improvement. Unfavorable prices have a tendency to reduce the total acres in improvement.

Crops with unrestricted crop acreages reduce the total pasture acreage during times favorable for the crop. During the past 3 years, many acres of pasture land have gone to soybean production. It should be realized that, in many parishes, especially the rice area, there is enough land now being used for grazing that a great expansion in soybeans can take place and still have adequate pasture land for present livestock numbers. However, to make this reduced acreage produce adequate forage, all recommended practices must be followed closely.

Generally, factors that affect production are an adequate fertility program, use of adapted varieties and use of good cultural and management practices.

The present number of livestock on Louisiana farms can utilize much larger quantities of forage than is now being produced. With present livestock numbers, an increase in the amount of forage produced would bring about a higher percentage calf crop, heavier calves at selling time and a higher milk production.

As forage production continues to improve, there is an opportunity for livestock expansion. The increased production could be used in the state, reducing the meat and meat products now being imported into Louisiana.

Overall, I would not be afraid to say that the total forage resource potential is almost unlimited if present technology were applied on every acre of pasture land. New technology is now being developed. When applied, it could easily produce enough forage for three times as many livestock as is on the farms now.

And this brings me to the main point of my talk today--the importance of agricultural research and education and the close-knit cooperation of both.

I have gone into a little more detail on my discussion of forage crops to show you some of the problems and potential that exists in this state for research work and for teaching farmers to properly manage their pasture land. Some of you may have some answers to our problems. This is just one area. In each of our crop areas there exists similar problems of lesser or greater magnitude.

There is not too much that I could say in praise of our research, teaching and, of course, Extension programs in Louisiana. In some areas we have done better jobs than in others, just as you in other states have done. In your states, just as in Louisiana, there are outfield experiment stations that help make the main stations more effective. The same is true of the relationship between county agents and the state office.

All of the southern states have had their difficulties with financing. Fortunately, I feel most of us are beginning to overcome some of these difficulties. I know we are in Louisiana, but still have a long way to go.

I have heard President Hunter say several times that the old standard of being the best in the South is no longer good enough. We need to be the best in the nation. I think each southern state should strive for that.

Believe it or not, the job should get easier as we go along. Problems of illiteracy are being overcome in the South; incomes are going up; more jobs are being provided; standards of living are on the rise, and we are getting into the mainstream of American life.

I know there is still a lot of joking about the South, some good-natured and some malicious, but we are beginning to laugh with them on the way to the bank.

Research workers in all phases of science, and that includes agriculture, are beginning to find more receptive ears for the problems they are facing. Maybe our financial and governmental benefactors are more enlightened than they were in previous years, but who are we to look a gift horse in the mouth.

But, along with this receptive attitude, there is more scrutiny on the part of those financing our work. They want to see results. They want to know how the dollar they have given is being spent. I say they are entitled to this.

One of the real bright spots on the horizon is the added emphasis in southern universities on basic research. For many years we have concentrated on applied research to show farmers that certain farm practices could be carried out. Now we are beginning to search into the whys and wherefores of some of the problems we have formerly just learned to live with.

But I think one word of caution is due. We must not become so involved with the basic research that we lose sight of the increasingly enlightened farmer in the South today. That is why these outfield experiment stations and Extension workers are so important. The work the researchers do will become more complicated, therefore. Extension personnel must be better trained to take the results to the field.

No matter how much we may seem to be working to publish research results, to satisfy department heads or to satisfy ourselves, we should never lose sight of the fact that the man we are really working for is out in the field, clearing an extra 100 acres to produce soybeans. He has to produce a crop every year.

For sometime now I have been saying that problems are opportunities. Our present problems in agriculture mean opportunities for farmers to expand production to meet the increasing demands of the market; they mean opportunities for research workers to come up with some answers to problems in production, marketing and utilization, and they provide opportunities for Extension workers to teach farmers the new and improved methods to produce more food and fiber on less and less farm land.

Louisiana's Research Programs for Cattle and Forage Crops - Doyle Chambers, Director, Louisiana Agricultural Experiment Station.

During the past 30 years, annual cash receipts from farm marketings to Louisiana have increased from a little over 100 million dollars to well over 500 million dollars. Livestock and livestock products have grown from about one-fifth of the total cash receipts to nearly two-fifths of the much larger amount now. The number of farms has declined from 170,000 thirty years ago, to about 60,000 today, with only half this number classified as commerical farms.

The 1964 census shows 2.7 million acres cropland harvested, 1.7 million acres cropland pasture, 1.7 million acres of woodland pasture, and 2.0 million acres of permanent open pasture. The number of brood cows, 2 years old or over, is somewhat less than one million head now, and the number of milk cows is about 230,000 head.

Livestock and forage crops research accounts for somewhat more than one-third of the total budget of the Louisiana Agricultural Experiment Station, this sum including, however, a considerable amount of self-generated income, that is, sales of beef and milk to buy feed, etc.

The research is conducted by staff members within the various departments on the LSU Main Campus and at several branch stations located throughout the state.

Research on livestock and livestock products is conducted within the Department of Animal Science, Veterinary Science, Dairy Science, Entomology, Agricultural Economics, Agricultural Engineering, Food Science, and Home Economics and is serviced by Experimental Statistics, the Feed and Fertilizer Laboratory, the Computing Center, and the Library. Forage crops research is centered in the Agronomy Department and is also supported by related Departments. A giant's share of the more applied research on the production of forage crops and their utilization by beef and dairy cattle is conducted at the branch stations, each station conducting for the entire state that phase of research for which it is best suited by available resources of land, livestock, facilities, and research talent.

In general, it may be said that the Departments of Animal Science and Dairy Science and the Iberia Station (cooperatively operated with the USDA) do most of the breeding and genetics studies on beef and dairy cattle. Crossbreeding studies, selection studies, and physiology of reproduction studies are the main areas of work. Fundamental nutrition research with beef and dairy cattle is likewise conducted by the same three units. Insect, disease, and parasite control studies are carried on by the Department of Entomology and Veterinary Science.

Again, in general, the more basic studies on the genetics of forage crops and the breeding of new strains or varieties are assigned to the Agronomy Department on the Main Campus, as are the more fundamental problems of plant nutrition, soil fertility, and plant-soil-water relationships.

Forage production research at the various branch stations looks to the evaluation of new varieties best adapted to the soil and climate of the area, their fertility requirements, seeding dates and rates, time of harvest, methods of harvest and storage, and nutritional values when fed to dairy cattle for milk and to beef cattle of various ages for maintenance, growth or production. The value of supplemental feeds of various kinds in forage utilization, either in grazing trials, silage or hay feeding regimes is determined at these locations. Costs of production data are obtained as is the value of the products.

Forage production research, and its utilization by milk cows, is conducted at the Southeast Station near Franklinton and at the North Louisiana Hill Farm near Homer. Dairy cattle feeding and management studies, with emphasis on nutritional needs of dairy calves, is conducted at the North Louisiana Station at Calhoun.

Forage production research, and its utilization by beef calves after weaning - the final product being a slaughter grade steer - using minimum supplemental grain is centered at the Northeast Station near St. Joseph and at the Macon Ridge Branch at Winnsboro.

Forage crop research, with emphasis on utilization by beef cows in the production of feeder calves, has been emphasized at the North Louisiana Hill Farm Station near Homer. The work at the Red River Station near Curtis and the West Louisiana Station near Rosepine has been a combination program of cow-calf utilization of forages and the finishing of the calves for slaughter using quality pastures, with or without supplemental feeding.

The forage work at the Rice Station at Crowley looks to those crops which fit best into rotation with rice and to their utilization by growing calves and yearlings. Drylot feeding research, to produce slaughter steers, using harvested forages and by-products of the rice, sugarcane and cotton industries is also conducted at Crowley.

The actual research is conducted under specific projects, which are planned by the researchers, and reviewed, approved and funded by appropriate administrative officers of the Louisiana Agricultural Experiment Station and the United States Department of Agriculture. This leads to coordinated programs of work with minimum duplication of effort, and leads to progressive research, that is, when one question is answered and the information block removed, all work is then reviewed in the light of the new status, and changes in programs are made as soon as ideas and resources are available for the new work. No research can be conducted except under an approved formal project which has specific objectives and procedures.

Louisiana's dairy industry has paralleled that of the Nation - fewer herds with larger numbers of cows per herd, and much higher production per cow. Higher investments in equipment, higher levels of feeding, a much greater need for high quality forages characterize the industry.

Artificial breeding to superior sires is the rule; and high levels of managerial skill are absolutely necessary to survive in this industry. As grains get scarce for cattle feeding, even more stress will be put on the quality of forage which may be available for the production of milk. The same can be said for the production of quality beef. Fortunately, we know that forage which will permit high levels of milk production will also cause rapid gains on beef cattle and vice versa.

Louisiana's beef industry has changed much in the past 30 years and these changes are not exactly the same as those for the Nation as a whole, either in degree or direction; and continued changes are likely to occur, within and without the state, which will have further impact on this industry. Louisiana has been, and still is, considered a cow-calf state - 30 years ago, largely for light weight calves which were slaughtered locally - more recently, for feeder calves to be shipped to other regions for feeding and slaughter at heavier weights. As a cow-calf state, Louisiana is not really competitive in productive efficiency primarily because of its low calf crop percentage - three cows are kept the year-round to produce two calves. At one time this was thought to be the result of reproductive diseases; but today, most of the trouble appears to be related to low levels of nutrition of the cow and bull at breeding time.

Low average weaning weights also are undoubtedly due largely to the inadequate amount and/or quality of the feed available to the mother cows during lactation. Research indicates that a properly designed crossbreeding program can improve both calf crop percentage and weaning weights, but these superior animals respond little unless they have access to ample nutrients, and are protected from the ravages of insects, internal parasites, and diseases.

Much of our additional resources for the near future are currently planned to strengthen research which may lead to more productive cow herds. Improved pastures - cool season or warm season - permanent types or annuals - opens the opportunity and need to explore fully and quickly the possibility of finishing Louisiana produced calves in Louisiana for the growing beef market in this area now provided largely from out of the region. At the present, this appears to depend upon how much quality forage we can produce.

With our long growing season, high rainfall, new cheap sources of nitrogen, and available land, it may be possible to change this state from a raw-product to a finished-product state so far as beef is concerned. It appears from research so far that an intensification of our forage and beef cattle programs could be expected to double, and perhaps quadruple, the annual income from beef cattle, using no more acres of land than now being used. This is worth shooting for! High cost grain nationally will put Louisiana in an even more competitive position, not only to produce for its own market, but for other areas as well. Already, we hear talk of scarce, that is, high priced grain, and if we assume an increasing US role in feeding other parts of the world, this cannot help but make grain for beef finishing much more scarce. If this state prepares to produce highly productive pastures and forage crops for feeding to more efficient beef cattle, it can play an increasing role in the production of quality beef, thus balancing its agricultural economy still further between crops and livestock. The real prospect for this is the basis for our growing investment in forage crop and pasture

<u>Residue Problems in Forage and Pasture Crops</u> - L. D. Newsom, Head, Department of Entomology, Louisiana State University.

Problems of pesticide residues on forage and pasture crops have become acute since the advent of the chlorinated hydrocarbon insecticides. Some of the reasons for this are: 1) For the first time, these new insecticides have provided a means of effective and economical control of forage and pasture crop pests and they have been widely used on these crops as well as in agriculture generally; 2) the propensity of the chlorinated hydrocarbons for storage and persistence unchanged in meat and milk, their ability to absorb residues from the soil and translocate them to aboveground plant parts, and the tendency for their residues to be concentrated in food chains and to move freely throughout agricultural ecosystems are unique properties which present special problems; 3) unprecedented refinements in analytical techniques have made possible the detection of residues in amounts that could not conceivably present any hazard to human or animal health; 4) anxiety in the mind of the public by extravagant and unfounded claims of hazards to humans arising from the presence of minute amounts of pesticide residues in food; 5) and an unreasong reluctance on the part of regulatory officials to set finite tolerances for pesticide residues in food products, especially milk.

The rapid replacement of the chlorinated hydrocarbon insecticides by the organophosphorus and carbamate compounds which do not possess many of the undesirable characteristics of chlorinated hydrocarbon insecticides has done much to alleviate the problem. These materials are less persistent, less subject to storage in fat, and much more subject to biochemical degradation than the chlorinated hydrocarbons.

Another problem, that of destruction of pollinating insects, is especially important in forage and pasture crop production since so many of these crops depend entirely upon insects for pollination. Unfortunately, some of the pesticides that are being substituted for the chlorinated hydrocarbons are extremely hazardous to the honeybee and wild bees. Hazard to these beneficial species can be alleviated by using the least toxic pesticides required for adequate control of pest species, and by making applications to coincide with the least amount of activity by the pollinators.

<u>American Forage and Grassland Council</u> - D. S. Chamblee - Department of Crop Science - North Carolina State University.

The history and objectives of the American Forage and Grassland Council were discussed briefly. Literature was distributed to the group illustrating the type of timely and useful publications prepared by the Council, and membership blanks were made available to those present.

Business Meeting - Chairman Fribourg, Presiding

Dr. Henry A. Fribourg expressed thanks to speakers and to Local Arrangements Committee for their contribution to the 1967 Southern Pasture and Forage Crop Improvement Conference. All who had not registered for the meeting were urged to do so. Abstracts or copies of papers should be sent to Permanent Secretary Leffel for the SPFCIC Report, 1967.

Dr. Woodhouse read a letter from Dr. R. L. Lovvorn, Director of Research, North Carolina Agricultural Experiment Station, in which the Forage Crops Workers at North Carolina State University invite the SPFCIC to meet at Raleigh in 1968. The motion to accept the invitation carried. Tentatively, the week of April 22 is the meeting date of SPFCIC, 1968.

Report of the Nominations Committee (Presented at Banquet) - The Nominations Committee (E. D. Donnelly, E. S. Horner, and E. C. Holt, Chairman,) report was presented by Dr. Holt and nominated Dr. C. L. Mondart, Jr., as a member of the Executive Council, SPFCIC. Motion to close nominations and to instruct the Secretary to cast an unanimous ballot for Dr. Mondart as Chairman Elect-Elect of SPFCIC was passed unanimously.

Report of the Resolutions Committee (Presented at Banquet) Resolved: That the 24th Southern Pasture and Forage Crop Improvement Conference hereby expresses the sincere appreciation of its membership to the administration and staff of Louisiana State University for the hospitalities extended and excellent facilities provided during the meeting in Baton Rouge, and the field trip to the Southeast Louisiana Experiment Station, Franklinton. We are expecially indebted to the Local Arrangements Committee of Mr. H. D. Ellzey, Jr., Mr. W. E. Monroe, Dr. C. L. Mondart, Jr., and Mr. C. R. Owen, Chairman. We wish to express our appreciation to the Louisiana State University staff wives for arranging an excellent program for visiting wives and families. Our thanks are offered to Chairman Henry A. Fribourg and Secretary R. C. Leffel who have served so effectively during the past year. Appreciation is also expressed to the program participants for the excellent presentation of papers and panel discussions.

The State of Louisiana is to be commended for its program of pasture and forage crop improvement. We move that these resolutions be recorded in the minutes of the meeting and that letters of thanks and appreciation be sent to Dr. J. N. Efferson, Dean, College of Agriculture; Dr. Doyle Chambers, Director, Louisiana Agricultural Experiment Station; and the local chairman, Mr. C. R. Owen.

Dr. Lincoln Taylor assumed the chair and declared the meeting adjourned.

Executive Committee Meeting - H. A. Fribourg, Presiding

The meeting of the Southern Pasture and Forage Crop Improvement Conference Executive Committee was called to order by Chairman H. A. Fribourg at 6:30 P.M. in Room 59 of Pleasant Hall, Louisiana State University on Monday, April 10, 1967. Present were Fribourg, L. Taylor, Schank, Owen, Gordon, Chamblee, Anthony, Riewe, Moore, and Leffel. Fribourg announced appointment of Nominations Committee and a Resolutions Committee, as follows:

Nominations Committee: Donnelly, Horner, and Holt, Chairman
Resolutions Committee: Gray, Schank, and Chamblee, Chairman

Fribourg read a letter from Dr. R. L. Lovvorn, Director of Research, North Carolina Agricultural Experiment Station: "On behalf of the forage crop workers at North Carolina State University we would like to invite the SPFCIC to meet at our institution in 1968, - - -", to be read by Dr. Woodhouse at tomorrow's business meeting. Chamblee indicated that the week of April 22 was preferred by the host institution, with Interest Groups meeting on Monday and SPFCIC meeting on Tuesday and Wednesday. A field day of one-half day may be offered.

Velez-Fortuño of Puerto Rico has informed Chariman Fribourg that an invitation is available from Puerto Rico for SPFCIC of 1969. Discussion on feasibility of location followed; L. Taylor was designated, via motion, to pursue this matter of invitation from the Director at Puerto Rico.

The program for 1968 was discussed. A 1 1/2 to 2-day program was suggested, with 1/2 day alloted to host institution, 1/2 day to papers, and 1/2 day to a field day. Should host institution prefer, part of their 1/2 day could be devoted to specialized subject matter. Communications between plant and animal interests were recommended. Program chairmen of S-45, SFBG, and SFPEWG were requested to consider all suggestions on Program and to consult the host institution and the SPFCIC Program Chairman, Fribourg, on the matter of first morning session, should the need arise.

The meeting was adjourned at 7:00 P.M.; the next meeting was scheduled immediately after the banquet.

Executive Committee Meeting - H. A. Fribourg, Presiding

The meeting was called to order at 9:30 P.M., Tuesday, April 11, immediately following the banquet, in the Royal Ball Room of the Student Union, Louisiana State University. Present were Fribourg, Owen, Schank, Moore, Mondart, Riewe, Anthony, Chamblee, L. Taylor, and Leffel.

The program for 1968 was discussed. Schank related that SFBG desired information on quality objectives in forages, possibly from Dr. Peter Van Soest. Mr. Riewe indicated that the S-45 meeting requires at least a day and that S-45 could not meet with other groups during its day's meeting. Moore suggested joint sessions of all interest groups, perhaps as much as one and a half days of SPFCIC meetings. Fribourg inquired of the advisability of starting interest groups and S-45 meetings on Monday, as week-end driving and travel

are required. Division of first day's meeting between host institution and symposia was discussed. Owen commented that host institution's participation draws attention of administration to SPFCIC. Riewe suggested that the first afternoon be devoted to "What the animal scientist needs from the plant scientist" and "What the plant scientist needs from the animal scientist." Chamblee suggested "Where are we on quality - what are we willing to accept?" This topic could include quality standards, forage testing programs, sampling and experimental design problems, and uniform testing. It was concluded by all that a 1/2 to 3/4-day session be scheduled on "Forage quality", for 1968, for all animal and plant interests.

Riewe announced that 10 states gave reports on grazing research in the South at Monday night's Interest Group meeting, that the group will meet next year, and that all interested are welcome. The group will probably meet the evening of S-45's meeting and will discuss "Experimental design in grazing trials."

Fribourg suggested early arrangement of Interest Groups programs, thus avoiding conflicts on mutual interest inasfar as possible.

A treatment in depth of one important species was suggested by Chamblee, perhaps a 1/2-day treatment by SFBG and SFPEWG.

In summary, the tentative programs appear to be:

| | SFBG | SFPEWG | S-45 |
|---|---|---|---|
| Day 1 | 1/2-day Joint program | | all day - |
| | 1/2 day | 1/2 day | business |

(Evening) Pasture Utilization Research Group -"Experimental Design in Grazing Research."

Day 2 1/4 to 1/2 day, Host Institution
1/2 to 3/4 day, Symposium, all Groups

(Evening) Banquet

Day 3 1/2 to 3/4 day Field Trip

The Secretary was requested to send copies of Minutes of the two meetings of Executive Committee, 1967, to all concerned as soon as possible.

The meeting was adjourned at 10:00 P.M.

The Chairmen (or their designated representative) and Past Chairmen of interest groups (1 vote per group) and officers of Southern Pasture and Forage Crop Improvement Conference, all constituting the Executive Committee of SPFCIC, for the forthcoming year are as follows:

| Group | Admin. Adv. | Past Chairmen | Current Chairmen and Program Chairmen |
|---|---|---|---|
| S-45 | C. E. Barnhart | J. E. Moore | C. H. Gordon |
| SFBG | O. B. Garrison | S. C. Schank | C. R. Owen |
| SFPEWG | R. L. Lovvorn | H. A. Fribourg | D. S. Chamblee |

| | | |
|---|---|---|
| SPFCIC | Past-Past Chairman | W. B. Anthony |
| | Past Chairman and Program Chairman | H. A. Fribourg |
| | Chairman | L. H. Taylor |
| | Chairman Elect | M. E. Riewe |
| | Chairman Elect-Elect | C. L. Mondart, Jr. |
| | Permanent Secretary | R. C. Leffel |

Utilizing Pastures with the Cow-Calf Herd - Marvin Koger

With managerial skill, good pastures and productive high quality cattle, commercial cow-calf operations can be competitive with other enterprises for land use in much of the southeastern United States. This applies especially to areas adapted to clover production.

Under prevailing costs of production, the operation most likely to succeed is one with clover interplanted in permanent grass pastures, along with a dependable winter feed supply such as hay, silage or reserve pasture properly supplemented. Increasing use of silage for winter feed appears probable.

One of the most vexing problems with which ranchers must contend at present is the deficiencies of warm season perennial grasses in grazing programs. With these grasses forage production is highly seasonal and except for a few spring and early summer months palatability and quality of feed under grazing is only fair to poor. Interplanting of clover increases the length of the grazing period through earlier grazing and improves the quality of feed. Poor growth response of cattle during the summer and fall months persists even in clover-grass pastures, however. Attempts to improve quality of feed through temporary pastures has not proven economical for cow-calf operations. Thus, the paramount need for beef cattle production in the Southeast is the development of longer seasons, higher quality grasses or an economical substitute for them.

Highly productive cattle of good quality are required for economical utilization of high quality pastures. The best outlook is for systematic crossbreeding to combine good milking ability, growth potential and modern carcass characteristics.

Utilization of Pastures for Growing-Finishing Cattle - Marvin E. Riewe

When one considers the topic of utilization of pastures by growing-finishing cattle there are a number of points that could be considered, each relevant to the subject of efficient production of beef. Today, however, I would like to limit this discussion to three species points.

First, exploiting the phenomenon of compensatory growth with cattle grazed on pastures; second, methods of maximizing gains on pasture for growing cattle; and third, ways of reducing the amount of grain required to finally finish an animal for slaughter. This would seem important in a grain deficient area where cost of grain is extremely high.

That compensatory growth does occur following a period of under-nutrition is, to my mind, a well established fact. The work of Winchester and Ellis (12), Winchester and Howe (13), Kincaid, Litton and Hunt (5), Ruby, Blunn, Brouse and Baker (11) and Heinmann and Van Keuren (3) and others leaves little doubt that the phenomenon of compensatory growth does exist. Therefore, the question does not seem to be does compensatory growth exist as a factor in beef cattle production, but rather, how best to

exploit this phenomenon.

To determine the means by which this effect can best be exploited, we should first consider the factors affecting recovery of the animal following a period of undernutrition.

Age of the animal at the beginning of the feed restriction period may be a factor. Black, et al. (1), Joubert (4), and Bohman (2) suggested that the older the animal is at the beginning of the restriction period, the greater are the chances of complete recovery being achieved. Winchester and Howe (13) found that complete recovery was affected in cattle restricted between 6 and 12 months of age, while Winchester and Ellis (12) found that complete recovery could be obtained in calves fed maintenance diets at the younger ages of 3 to 6 or 4 to 8 months. Retardation of growth earlier than about 3 months, however, may have a deleterious effect on subsequent recovery. If we accept 6 months as a minimum age at which complete recovery occurs following a restriction in feed, then it follows that undernutrition could be practiced at any time following post-weaning. For the subject under discussion here today, we shall restrict our remarks to calves beyond post-weaning age.

The second item affecting recovery rate following undernutrition is the length of the undernutrition period and the level of feeding below sub-optimal nutrition. A review of the literature on this point is somewhat confusing in that several workers suggest several levels of gain during the period of undernutrition in order to obtain maximum benefit from feeds supplied following a period of undernutrition. Recommended rates of gain vary from 1/2 lb. per day during periods of undernutrition to 1 1/4 or more pounds per day gain. This appears to be a conflict and it does not seem possible to resolve this simply on some kind of average rate of daily gain. Rather it appears necessary that we look at the length or duration of the undernutrition period in conjunction with the level of nutrition during this period. The literature suggests that if the periods of undernutrition are relatively short, then complete recovery can be experienced even if no liveweight gain occurs during the period of undernutrition. On the other hand, if the period of undernutrition is to be lengthy, approaching 6 months in length, then simple body maintenance with no liveweight increase may be deleterious.

A third factor to consider is the nature of the nutrient restricting growth during a period of undernutrition. I would like to recognize it as a factor; however, a limited review of the literature makes it difficult to pin-point a specific nutrient likely to restrict growth to the extent that complete recovery is not possible.

A fourth factor affecting recovery of the animal following a period of undernutrition is the plane of nutrition following undernutrition. If the plane of nutrition following the restricted feeding is high, then recovery occurs at a rapid rate. If, on the other hand, the plane of nutrition remains at a fairly low level, the period of recovery is extended and complete recovery may be impractical.

Meyer _et al_. (7) mainatined two groups of animals at two different levels of energy intake for 172 days. The first group was fed to gain 1.76 pounds per day while the second group was fed to gain .77 pounds per day. Following this 168 day period, both groups of steer calves were placed on pastures for 124 day period. While on pasture the steers were grazed at three stocking rates. In no case were the steers fed at the low level of energy during the winter able to completely recover difference in gain during the wintering period. In this study compensatory growth recovered, on an average, 98 pounds of the 168 pounds difference at the beginning of the grazing season. Attention is called to the fact that the period of undernutrition was 48 days longer than the period of grazing.

In the Virginia study by McClaugherty and Carter (8), steer calves were wintered at 2 levels of gain over a 4-year period. Winter feeding period was approximately 140 days. Calves were wintered to gain 1.43 and .95 pounds per head per day resulting in a difference in gain during the winter period of 65 pounds per head. Following the wintering period, the steers were placed on pasture for 170 days. Calves wintered to gain 1.43 pounds per day gained 181 pounds during the subsequent 170 day pasture period. On the other hand. those wintered at a medium gain level gained 224 pounds. Thus 43 pounds of the 65 pounds difference was recovered.

Lawrence and Pearce (6) in British work wintered steers between 38 and 52 weeks of age at levels to gain 1.61, .74, .03 pounds per head per day for a period of 168 days. Following this wintering period, the three groups of cattle were placed on pastures for a period of 140 days. During the wintering period steers, fed a high plane of nutrition,gained 266 pounds more than steers gained on the low plane of nutrition. The difference between these two groups at the end of the 5-month pasture period was reduced to 74 pounds.

In a study at Angleton, Texas, two groups of steers were wintered at levels to gain 1.2 pounds per head per day and maintenance. Following a 100 day wintering period the steers were placed on Dallisgrass-white clover pastures at stocking rates of 1 and 2 steers per acre. The steers remained on pastures for 212 days. Thus, the pasture period was more than twice as long as wintering period. Under these conditions, cattle wintered to produce no liveweight gain, weighed nearly the same at the end of the pasture period as those wintered to gain 1.2 pounds per head per day. On the other hand, steers grazing pastures at two steers per acre and fed to maintain body weight during the winter showed only slight compensatory growth during the grazing period. Only about 25% of the weight difference at the beginning of the grazing period was recovered.

The work of Meyer _et al_. (7) offers two explanations for compensatory growth for cattle grazing on pastures following a period of undernutrition. First is the clear increase in feed intake and secondly, an increase in efficiency of energy utilization independent of feed intake. The phenomenon of compensatory growth in itself does not appear to influence the digestibility of the gross energy consumed.

These studies seem to suggest the following: (1) the ability of steers at post-weaning age to recover following a period of feed restriction

depends both on the length of time of feed restriction and the degree of feed restriction, and (2) the ability to recover depends upon the level of nutrition following a period of feed restriction.

In much of the Southern United States we experience relatively mild and relatively short winter periods followed by relatively long grazing periods. Under these conditions, the available data suggests that higher rates of gain during the winter period are not essential if the calves are to be grown out on pastures. In fact, levels of nutrition to provide maintenance or slightly above may be adequate, if this is to be followed by a relatively long grazing period on relatively high quality pasture. Money spent on feed to provide higher levels of gain during the winter beyond this point may well be lost by the end of the grazing period.

While it appears that reduced rates of gain during the wintering period to be followed by a growing phase on pasture can be tolerated and perhaps exploited, this does not appear to be true for the growing period on pastures. If we consider a finishing program, the rate of gain of pasture appears to be an extremely important factor in reducing the time required to finish the cattle in the feedlot and in reducing the total amount of high energy feed required. One such example is a study conducted at Angleton, Texas, in 1961 and 1962. In a grazing management study on Dallisgrass-white clover pastures, stocking rates of 1 1 1/2 and 2 steers per acre were used. The average gain per head on pasture was 253, 200, 152 pounds, respectively, for stocking rates of 1, 1.5 and 2.0 steers per acre. Following the grazing period, these groups were fattened in the feedlot. Steers grazing pastures at 1 steer per acre finished in the feedlot in 78 days, requiring a total of 1916 pounds of the fattening ration per head. Steers grazing pastures at 1.5 steers per acre required 96 days and 2301 pounds of the fattening ration to reach a similar weight and condition. Steers grazing pastures at 2.0 steers per acre required 111 days and 2572 pounds of fattening ration to reach a similar weight and condition. If we consider the total growing-finishing period, then 449 pounds of high concentrate finishing ration were required for each 100 pound of body weight increase in the growing-finishing program when steers grazed pastures at 1 steer per acre. This is compared to 512 pounds per hundred weight body gain when steers grazed pastures at 1.5 steers per acre and 627 pounds per hundred pounds body weight gain when steers grazed pastures at 2 steers per acre. Thus, factors affecting weight gain during the growing period on pastures are critical in reducing the amount of grain required to finish the cattle as well as reducing the time required in the feedlot. Not only can stocking rate effect body weight gain while on pastures but other agronomic treatments applied to pastures are also important. Agronomic treatments, applied to increase forage quality and/or quantity to the extent that higher rates of gain per animal may be obtained, play a significant role in reducing the amount of grain required to finish the animal for market.

It is generally recognized that it is more difficult to reach a desirable slaughter grade with cattle on pasture alone. Generally, additional high energy feed in the form of grain is required to reach a desirable slaughter grade. Interest has been expressed in the possibility

of supplementing pastures with grain in order that a more desirable slaughter grade might be obtained by the time cattle are removed from pasture. Another relevant question is the efficiency of such grain feeding as opposed to reserving all of the grain for a dry lot fattening period following the grazing period. Several such studies have been conducted.

At the Coastal Bend Experiment Station at Beeville, Texas (9 and 10), 2 years of work have been done with young cattle grazing oat pasture. Grain was fed to heifers or steers on oats followed by a short finishing period in the feedlot as opposed to similar cattle grazing only oat pastures until the end of grazing and then finished in the feedlot. Heifers were used in the first year of this study, while steers were used in the second year. In either case, less grain was required and returns were higher when all of the grain was reserved for the feedlot period following the grazing period. If the efficiency of the grain utilization is considered in a total program, then the efficiency was markedly in favor of reserving all the grain for the end of the grazing period.

Similar results were obtained by McClaugherty and Carter (8) in Virginia work. Steers fed on pasture reached a finish grade earlier but the grain was more efficiently utilized when reserved for a drylot period at the end of the pasture season.

In summary, it appears that undernutrition can be used at times to reduce costs by exploiting compensatory growth. Grazing management practices that favor a high rate of gain on pasture are important in reducing the amount of grain required to obtain a desired kind of carcass. On the other hand, feeding grain on pasture appears to be an inefficient method of utilizing grain in finishing cattle for market. Reserving all the grain for a drylot period at the end of the grazing season favors the more efficient utilization of grain.

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Measuring Pasture Utilization with Producing Dairy Cows - Chester H. Gordon

Agriculturalists are in general accustomed to the complex and variable results that arise from several factors simultaneously affecting a single biological system, i.e., plant or animal. To involve oneself with the complexities arising from the interactions of both of these systems as in pasture investigations requires that an individual be particularly; 1) astute, 2) foolhardy, or 3) devoted. To prove the first would be difficult. The second may be accurate but unpleasant. The third possibility can easily be supported by the immense effort that has been directed to such studies and the importance of pastures as a forage resource. However, being devoted has not been enough to develop an understanding of how milk cows do and should utilize pasture. I include my own efforts when I say that most pasture utilization trials have been confounded by uncontrolled variables or subjective judgments.

Much of the difficulty arises from the fact that both the plant and animal systems are dynamic and each affects the performance of the other. It is very difficult to hold one parameter constant while studying the effects of variables in the other. The quantity and quality of herbage changes daily as does the physiological state and production potential of the grazing animals. For example, it becomes virtually impossible to study the effects of grazing intensity on similar pastures because when grazing intensity changes, the pastures tend to become different with regard to plant species, soil structure, fertility status, root reserves, regrowth pattern, and disgestibility.

The ultimate usefulness of pastures, to a large extent, will depend upon accurate, definite measurements of treatment effects. Such measurements are necessary for developing and recognizing pasture treatments of the greatest value.

Measuring Utilization - In the most simplified terms, utilization could be determined by measuring the amount of forage consumed by dairy cows. This approach is not completely satisfactory since greatest interest is not in disappearance of the forage but in appearance of a saleable product. Knowledge of forage consumption is of great use in explaining observed animal responses but is not itself a satisfactory final measure of utilization.

Greatest interest lies in measuring the net contribution of pasture to the nutritional support of the cow. Recognizing that pasture can contribute to the cows' requirements for maintenance and gain in body energy, as well as milk production, a system of calculating the total TDN requirements for these functions and the net contribution of pasture has been developed and used for many years (1), (9). This calculation may be simply expressed as: TDN from pasture = TDN for maintenance + TDN for milk + 3.53 (lbs. of liveweight gained) - 2.73 (lbs. of liveweight lost) - TDN content of supplemental feeds. If an investigator had complete confidence in the validity of this calculation he would be relieved of the need for balancing cow groups with respect to size, stage of lactation or production level, since the calculation provides a common denominator for pasture TDN utilized regardless of the function for which it is used. Apparently few people are willing to place this much reliance on the calculation and attempt to test all treatments with cows of similar requirements.

The major source of error in using animal requirements for estimating pasture utilization involves the variable relationship between changes in liveweight, changes in body energy, and TDN requirements. While this difficulty occurs to some extent in all types of feeding trials, it is particularly acute in grazing animals since there is no opportunity to arrest changes in quantity and quality of forage on the grazed area for a few days while gastro-intestinal fill becomes adjusted to a base level. The use of a shrinking or fasting period prior to weighing reduces errors due to fill but is incompatible with good dairy cow management.

Some concept of the magnitude of the error of fill changes is afforded by the report of Balch and Line (2). A part of their data is presented in Fig. 1. Fistulated cows were grazed on an improved pasture for 22 days following a winter barn feeding period. Average daily weight gains on these cows during grazing were about 0.9, 0.7 or 3.3 pounds when the day previous to grazing, the first day, or the second day of grazing was used as the initial weight, respectively. These gains represent 3.2, 2.5, and 11.6 lbs. of TDN by use of the suggested conversion factor of 3.53. When the liveweights were adjusted for the determined weight of rumen contents, the daily gains were 1.3, 0.6, and 0.8 lbs. or 4.6, 2.1 and 2.8 lbs. of TDN. Clearly, changes in rumen fill have an important influence on liveweight changes and thus on calculated TDN values for pasture.

If it were possible to make complete corrections for changes in fill, changes in body energy content which are not reflected in body weight would remain as a source of serious error. The data presented in Table 1 were derived from those obtained from one high producing cow on which 19 complete energy balance and TDN determinations were made during 305 days of lactation (3). This cow displayed major shifts in liveweight during the lactation as would be expected of a cow producing over 19,000 lbs. of FCM. These liveweight changes, as summarized in Table 1, were equivalent to daily TDN changes ranging from -11.2 to +7.7 lbs. on the basis of the suggested factors(1). However, on the basis of known feed TDN intakes, the TDN balance ranged from -25.8 to + 15.7 lbs. per day and the actual TDN equivalent of liveweight gained or lost varied tremendously within the lactation. It is apparent that an attempt to evaluate the contribution of this cow's ration by the reverse feeding standards procedure would have involved a serious over-estimate in early lactation and a serious under-estimate in later lactation.

The variable relationship between liveweight change and body energy change must largely be explained on the basis of variations in the energy content of weight lost and gained at various times during the cycle. The difficulty caused by this variability would be largely overcome by development of suitable methods for in vivo determination of body energy. It should be noted that the factors for converting liveweight changes to TDN (9) were originally derived from the energy content of weight gained by steers (2692 Kcal per pound). The liveweight loss of this cow however, was equal to 4161 Kcal per pound in early lactation. The accuracy of the value used becomes relatively less important in long trials where initial losses tend to equal subsequent gains. But during periods of a month or two, the error can be serious. In terms of forage development and changes in the physiological state of the lactating cow, however, a month is a long time and may be of considerable interest.

<u>Measuring Milk Production</u> - An alternate approach to pasture evaluation is to ignore criteria such as forage production, consumption, and nutritive value and the intricacies of animal requirements and simply measure the amount of milk produced. This approach is very attractive in terms of simplicity and economic applicability of results. However, it is much more demanding in terms of design. Factors such as balance in cow groups and grazing pressure are extremely important determinants in the results of such trials.

It is essential that one keep in mind that the milk produced from a given pasture is limited either by forage potential (the quantity and/or quality of forage) or by the potential productivity of the animals used. The concept of forage and animal limitations on productivity has been graphically presented by Ivins (7) and an adaptation of his publication appears in Fig. 2. Although the indicated responses may be overly simplified, they illustrate the point that milk production cannot be considered a pasture response unless it is clear that pastures and not cows are limiting. Thus, different pastures producing equal amounts of milk may reflect only accuracy in balancing the potential of cow groups rather than equality of pastures.

The relative importance of measuring milk response per cow or milk produced per acre depends largely on economic factors. It has been amply demonstrated that milk per acre is consistently and significantly increased if grazing pressure is increased at least to the point of noticeable decrease in production per cow. With existing U.S. price relationships, there is little interest in grazing methods or pastures that significantly reduce production per cow. However, there are good reasons for interest in measuring milk/acre with grazing pressures as great as can be tolerated without serious depression in production per cow. The theoretical relationships between stocking rate, production per animal, and production per acre have been developed by Mott (10). The development of data to verify these per acre vs. per animal relationships has been most notably accomplished with meat animals. The data of Riewe <u>et al</u>. (11), Fig. 3, illustrates how these relationships can be developed and used in comparing pastures for steer gains. It is clear from these curves that the relationship of per animal gains, per acre gains, and stocking rates are distinctly different for the two forage species under study.

Attempts to develop data demonstrating this full relationship in dairy cows have not been nearly as successful. In an extensive experiment reported by Hancock (6) a 40% reduction in pasture area resulted in a 13% reduction in milk per cow but a 30% increase in milk per acre. The point of decreased gross return was not observed because of adaptation of the cows on the restricted area. Although Hancock suggests that more complete utilization of available forage was the primary adaptation mechanism, the data also indicate that differences in body energy content could have been involved. Experimenta at Beltsville (4), in which three grazing intensities were employed, also failed to demonstrate a rotational grazing intensity high enough to result in reduced milk per acre. (Table 2). This occurred even though the highest intensity resulted in no measurable forage residue and a depression of plant recovery rate. It would appear that very effective cow adaptation mechanisms were also operating in this high intensity situation.

Obviously, progressive increases in cow numbers as related to available forage cannot continually result in greater milk yields per acre since a progressively greater proportion of the forage energy is required for animal maintenance. The question of why this reduced efficiency cannot be as readily observed in dairy cattle as in growing cattle is not easily answered. One of the primary confounding factors is that cows are not altogether dependent on feed for milk production since they can and frequently do produce considerable milk from body energy. Furthermore, the extent to which individual cows persist in milk production during a negative energy balance is highly variable. Growth or body gain, on the other hand, is quite directly dependent on feed consumed. Extension of observation periods to allow equilibration of feed intake and milk production is hardly a satisfactory way to achieve energy balance since this precludes pasture evaluation during relatively short periods that may be of extreme interest. The relatively small response of cows to increasing levels of offered pasture was reported by Greenhalgh (5), Table 3. At the lowest level of offered herbage about 96% was consumed. By offering about 79% more herbage (Level 3) a 16% increase in intake was observed but only 62% was consumed. The associated increase in milk production was relatively minor, 5%. The 3- to 4-week periods were of sufficient length to be of considerable agronomic interest. Clearly, production and consumption per animal are much less sensitive to changes in intensity than in production per unit of forage offered.

The promiscuous use of stocking rate as an expression of grazing intensity can result in confusion. Stocking rate is simply an expression of the number of animals per unit of land area. Grazing intensity, on the other hand, expresses, in absolute or relative terms, the relationship between animal number and the available forage. If forage yield per unit area is not equal across pastures, relative stocking rates will not be identical to relative grazing pressures. The assignment of equal animal numbers to equal areas is in no way an assurance of equal grazing pressure.

Frequently, reports of pasture studies for milk cows which have been conducted with one cow group per treatment include the following data: Milk production per cow day; stocking rate or animal days per acre; and total milk per acre. In table 4, the first two factors have been arranged in all possible combinations of equality or non-equality among treatments. In all situations except the 4th, the relationships among treatments in milk/acre are fully predictable from the relationships in the first two columns.

It is revealing to consider the differing sets of true conditions that could yield these four sets of results if one assumes that cows were grouped with care according to production potential.

Situation I

A. Equal milk production per cow resulted from equal grazing pressure on pastures of equal potential.

B. Equal milk production per cow resulted from low grazing pressure on all treatments. Pastures were in fact of different values but the experiment gave no opportunity to express this difference.

Situation II

A. All treatments produced the same amount of forage and were grazed at the same high level of grazing pressure. The results are indicative of a difference in milk potential.

B. Treatments produced differing amounts of forage and were grazed at different levels of intensity. Milk per cow differences are a reflection of different grazing pressures applied to pastures of equal forage quality.

Situation III

A. Grazing pressure was equal and pastures are truly different by virtue of different amounts of forage of equal quality.

B. Grazing pressure was moderately different resulting from subjective unequal stocking rate assignments to pastures of equal forage growth. Cow adaptation to the greater grazing pressure was complete, thus the apparent pasture difference is an artifact.

Situation IV

The interpretation of this situation is relatively simple if a single treatment shows both a high stocking rate and a higher milk per cow rate. Such a treatment is clearly superior although the full extent of superiority may be unknown. If a single treatment does not excell in both characteristics, the interpretation is usually confused.

This exploration of possible explanations of different result situations is by no means exhaustive. It should serve to illustrate the limited possibilities for clear defensible interpretation of data. Only in situation IV is the interpretation clear in the absence of grazing pressure as a controlled variable. It is disturbing to consider the numerous reports that fit situations I, II, and III and the necessity of subjective interpretations. Milk per acre is the simple mathematical product of stocking rate and production per cow, and is devoid of meaning in the absence of information showing the relationship between stocking rate and grazing pressure. Kennedy et al. reached similar conclusions when interpreting their data from pasture management studies (8).

It eventually becomes the burden of critics to suggest alternate courses of action. This in turn may lead to criticism of the critic. In order to preserve this chain of events, the following suggestions are made. Some types of pasture treatments are of interest because they may increase milk production per cow (e.g. treatments providing a particularly palatable or digestible forage). This characteristic can be objectively studied with sufficient cow replications without any particular regard to stocking rate, intensity of grazing, or milk per acre. If, however, one wishes to assess the broader aspects of carrying capacity and milk per acre potential of

pasture treatments, it becomes necessary to adopt an experimental approach which will identify several production levels with specific grazing intensities within each treatment. This cannot be systematically done with only one stocking rate or grazing intensity per treatment.

After having satisfied the design requirements a choice of what criteria to measure remains. The errors associated with measuring milk production or calculated animal requirements make them of questionable value especially in short term experiments. If reliance on these criteria is unavoidable, errors may be reduced by using cows in mid-lactation, since liveweight and body energy changes tend to be least during this period. Careful direct measurements of the digestible nutrients obtained by the grazing animals appears to offer a better possibility for realistic evaluation of pasture utilization. Divergence of these values from calculated requirements on milk production should be regarded as errors in the latter unless contrary data are developed.

Resources may not permit an adequate grazing design and a direct measurement of digestible nutrients grazed. In this case, stall feeding and digestibility determinations along with forage yields and plant persistency measurements on grazed areas seem to offer a better possibility for treatment evaluation than an inadequate grazing experiment.

It is hoped that these remarks are not interpreted as low estimate of the value of pastures for dairy cattle. On the contrary, pastures are a valuable resource. However, clear definitive data are necessary for a realization of their value and distinguishing truly superior pasture treatments.

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NOTE: Figures 1, 2, and 3 and Tables 1, 2, 3, and 4 were not reproduced and were available in copies of paper distributed at meeting.

Role of Pastures in the Future - D. E. McCloud

It is a pleasure to be with you again for the Southern Pasture and Forage Crop Improvement Conference. For the past 20 years I have attended most of these conferences, and I am happy to be back again this year.

As a basis for prognostications for the future, one generally first looks backward to determine what has happened -- what are the trends -- before deciding where we are heading.

All of you know in this county, and in the South, the application of pasture technology has lagged that for grain crops. Today we see many of the same underfertilized, poorly managed, low producing pastures that were common 20 years ago.

The same is not true for grain crops. For example, average statewide corn yields in Florida now are 270% of those 20 years ago, going from 11 to 30 bushels per acre. In Georgia it is 350 percent, going from 12 to 42 bushels per acre. For North Carolina the figures are 270% and 22 to 59 bushels per acre. These are typical examples for other states in the South. The picture is similar for other crops. Why have grain crops yields increased so spectacularly while the application of pasture technology lagged?

Has this happened in other countries around the world? The answer to this latter question is no. Many countries have developed their grassland production much more comparably to their grain production.

In the Netherlands, for example, grassland technology is highly developed. Milk production per cow is at the highest level of any country in the world -- 10,000 pounds per cow. Dutch dairymen achieve this kind of production using pastures as almost the sole source of feed. During the grazing season, concentrates are almost never fed on pasture.

Similarly in the British Isles beef cattle and lambs are fattened for the market with little or very low levels of concentrate feeding. Pastures furnish the principle feed. Grassland agriculture is highly developed.

In the United States we have done almost the opposite. Our dairy cows are fed very high levels of concentrates. California dairymen, one of the highest states in milk production per cow, just over 10,000 pounds, feed high levels of concentrates and seldom use pastures.

Similar emphasis on grain feeding is prevalent for beef cattle. The number of grain-fed cattle produced in this country has increased from 30% of all cattle marketed to more than 60% since 1935. The United States is the only country in which significant numbers of beef cattle are fed large amounts of grain to be fattened for market.

Why has the United States adopted the high grain philosophy in dairy and beef production? I believe the answer has been surplus grains.

Other countries having greater population pressures simply could not afford to feed large amounts of grain to livestock. For them humans were in competition with livestock for "feed" grains.

The world population explosion has brought about the disappearance of our grain surpluses. Livestock producers now are feeling the pressure of more costly grains. As this pressure grows less grain will be used in beef and dairy rations.

If we are to continue to eat large amounts of beef and dairy products, more efficient use of pastures must be made.

High yielding, well managed pastures can compete with grain crops in terms of economic returns. Many studies in the South have shown that beef gains of 300 or more pounds per acre can be achieved. This is a gross return of $66 per acre at today's beef price. This equals the gross return from 50 bushels per acre corn crop. While 300 pounds beef and 50 bushels corn are comparable in gross returns, production costs are quite different.

Recent studies at the University of Florida show net returns of $21 per acre for a cow-calf enterprise on flatwood lands with clover grass pastures. This compares quite favorably to a net return per acre of $24 per acre for corn on an Illinois grain farm with corn yields of 107 bushels per acre. These two studies indicate that in terms of net return 300 pounds beef equals 100 bushels corn.

If economic returns can be similar, why then has application of pasture technology lagged that for grain crops? The answer lies in the comparative ease in achieving similar dollar returns. The prescription for high corn yields is simple, use a recommended high yielding variety, apply a specified grade and amount of fertilizer, plant for a specific plant population, use a certain herbicide and the returns are highly predictable.

On the other hand, a simple prescription does not exist for producing 300 pounds of beef per acre. Complex soil-plant-animal interrelationships make this much more difficult. A multitude of interacting factors come into play. Results are not always predictable. Only the most skilful manager can achieve his goals. This is another reason for the lagging application of pasture technology.

Today we need to simplify the pasture prescription studies on the most economical systems for beef and dairy production, and we must not be mislead by yesterday's cheap grain.

The South has ample acreage of abandoned or underdeveloped lands which can be used for a greatly expanded livestock enterprise. Some states are already well underway in this development.

We must not be mislead by economic studies which are based on surveys of existing farm practices. To compare today's high grain yields with low producing pastures is not meaningful. The potential for high production from pastures exists. Much research from agricultural experiment stations has confirmed this potential. Other countries have shown it can be done under practical farm conditions. We too must move in this direction to maintain desirable levels of livestock products in our diets. The challenge is here; industry, extension, teaching, and research each have important roles to play if we are to capitalize on this real opportunity in the South.

Dilemma of the Public Plant Breeder - E. D. Donnelly

Some forage breeders in the Southern Region have been concerned about the difficulties involved in getting varieties in use following release.

To obtain meaningful information on this subject, a questionnaire was sent to 25 forage breeders in this Region. Eighteen responded. At least one response was received from each of the 13 states and Puerto Rico. All who responded did not answer all questions. However, the majority did and, as requested, gave additional information on these problems as they saw them. (The speaker was one of the respondents). Information obtained follows:

A total of 77 varieties (plus two newly released) have been released by the 13 states, each state having released at least one. Of these, 33 (or 43%) did not reach their potential.

The following production factors were given as cause of failure (the number in ( ) is total number of times each was checked): environmental conditions (7); lack of interest (7); lack of adequate producers (8); seed supply exceeded demand (2); and undue time lag between release and seed (or sprig) availability (6).

Promotion and marketing factors given as to cause of failure and total number of times each was checked follow: Seedsmen were not made aware of superiority of the variety (6); farmers were not informed of variety superiority (8); profits were not adequate for seedsman (8); and price of seed (or sprigs) was not competitive (2).

Six respondents said they believed present methods of variety release are adequate. Nine said present methods of release are inadequate.

One respondent felt that if a variety has merit it will almost sell itself. However, most believed that there are numerous problems connected with getting a variety used to its potential.

Problems given are as follows:

Public plant breeders are restricted by state boundaries, whereas private plant breeders (seed companies) are not.

A large number of species is used in this Region, some being of relatively minor importance and some being "new" species. Advantages of these are not always clear. They are unfamiliar to farmers, species may require different management practices, and as a result they are difficult to get into production. There is insufficient volume for those who wish to produce seed profitably; the demand for seed is too small to stimulate seed production; and small growers lack know-how, financing, and means of promotion.

Seed is a specialized business. Few farmers are willing or are qualified to change to production of seed. Also, seed production is often secondary to grazing.

More cooperation is needed between public forage breeders leading to final stages of varietal release, between states and USDA regarding joint release of certain varieties, and between states for interstate testing before variety release. Failure to do the latter prevents recommendations by other states, reduces demand for seed, causes the variety to be unprofitable for seedsmen, and may cause variety to fail.

We need an adequate evaluation program to parallel the breeding program. These should be in the areas of biochemistry, pathology, entomology, nematology, management, and utilization.

A better research program is needed on seed production practices such as chemical weed control; seeding rates, row spacing, and other agronomic practices; insect and disease control; irrigation; defoliation and desiccation; and harvesting, drying, and storing.

In some cases inadequate effort is made in producing foundation seed. Genetic purity is not properly maintained, germination is low, and noxious weeds are not properly controlled. Also, quantity of foundation seed sometimes is insufficient to permit rapid build-up of registered and certified seed. Reserves of foundation seed are not always sufficient to ensure a continuing supply in case of crop failure.

A better coordinated effort is needed among departments; in timing release with adequate seed supply; and among experiment station, foundation seed stocks organization, crop improvement association, extension service, seed producers, and seed dealers.

A better education program is needed to make possible a more efficient seed program generally. Those who should be included are research personnel, foundation seed personnel, certified seed inspectors, extension personnel, seed producers, seed distributors, and state seed analysts.

Publicity and promotion are needed. Timely pre-release publicity is necessary. We must synchronize seed increase with information and publicity regarding merits of the variety. Advertising is needed to create demand. Public plant breeders cannot create markets as effectively as industry.

Marketing is important. We must have an adequate, dependable supply of quality seed reasonably priced. There must be a proper balance between supply and demand.

ACP should pay a premium for seed of improved varieties. Failure to do so has discouraged use of improved varieties in many instances.

Environment in the Southern Region, particularly the Southeast, is often not conducive to best seed production. Diseases build up during warm, humid seasons. Insects are important. The clover head weevil has curtailed use of crimson clover varieties for example. Use of a newly released alfalfa variety was restricted when the alfalfa weevil became serious. Much of the region is subject to extremes in temperature and rainfall.

How might we get out of this dilemma? (1) First, we obviously need to correct those deficiencies mentioned over which we have some control. (2) We need to improve efficiency of conventional release procedures through foundation seed organizations, and crop improvement associations. (3) We might use more effectively the National Foundation Seed Project in increasing seed of certain varieties. (4) Certain other varieties may be released through organizations having orderly production and marketing facilities. These could include an organization of producers, or one or more commercial seed companies.

The method of release may be determined in some cases by policy relating to seeds and other propogation materials of field crops.[1/]

Variety Release and Distribution Policies of the Agricultural Experiment Station - John A. Ewing.

It is indeed a pleasure for me to appear on your program and discuss variety release and distribution policies. Most of my remarks will be taken from a recent revision of the statement of responsibilities and policies relating to seeds and other propagation materials of Field Crops. I served as a member of a seed sub-committee of ESCOP with Dr. Fortmann, Pennsylvania, as Chairman; Dean Frolick, Nebraska; Director Ensign, Idaho; and Dr. Martin Weiss of ARS, USDA; and we developed this report.

This committee was appointed in 1965 and our report, after approval in all 4 regions, was accepted by E.S.C.O.P. on February 28, 1967, after five drafts had been circulated. Suggestions from the Directors and Plant Breeding Staff, of the Experiment Stations, from concerned groups of ARS, SCS, USDA, from the International Crop Improvement Association, from the American Seed Trade Association and from the National Council of Commercial Plant Breeders were considered each time by the Committee. At times it looked almost hopeless; however, I feel the final approved document is an improvement over each of the revisions circulated and fairly reflects the intent of the charters of the diverse groups I have already mentioned.

I think it might be well to begin with a brief review of Experiment Station actions in this important area of work over the past several years.

As early as 1945 there was developed in the North Central region a statement of policy covering part of the steps that are involved in the development, increase, and release of new varieties. During the period of 1949 to 1951 a Committee of the Southern Directors, working with representatives of the Agricultural Research Service of the U. S. Department of Agriculture, developed a somewhat more comprehensive statement of responsibilities and policies. That statement was adopted as recommendation by the Directors of the Southern Stations in November 1951 and referred to the Experiment Station Committee on Organization and Policy for transmission to the directors of state Stations in the other three regions.

1/ A Statement of Responsibilities and Policies Relating to Seeds and Other Propogation Materials of Field Crops.

In June of 1952, the Directors of the North Central States revised the statement slightly and approved it in principle, but reserved "the right to continue more detailed and exact policies in this region than are prescribed in this statement."

During 1953 and 1954 the Northeastern and Western Directors reviewed both the Southern and North Central drafts and through their representative on the ESCOP subcommittee developed further suggestions and indicated approval of the revised statements. Suggestions from each of the regions were considered by the chairman of the committee and the designated representative of the Agricultural Research Service in preparing a draft, dated June 1954. Practically every change suggested in the original Southern draft by the North Central, Northeastern and Western groups was incorporated. Several corrections were made so as to both clarify and strengthen the statement. The statement as revised was approved by ESCOP in November 1954. Additional revisions were made and approved by ESCOP in April 1962.

Changes in patterns of variety release and seed multiplication and distribution, along with other developments, indicated a need for re-examination of the policy statement adopted April 1962. Accordingly the Seed Policy Subcommittee was reactivated in 1965 to re-examine the Policy Statement and make appropriate changes and additions. This we have completed.

Adaptations to specific crops will be required. The statement is designed largely to outline general policies and procedures and to point up general functions and opportunities for improving both public and private activities and services in the development and use of improved seeds and other propagation materials.

The State Agricultural Experiment Stations and the Department are obligated to conduct studies of the characters and properties of plant materials, modes of reproduction, the inheritance of characters, and the possibilities of modification and control of heredity. These agencies and their workers are further obligated to make the results of these studies available to all plant breeders, institutional or private, through prompt publication of research findings.

Basic genetic materials from such studies should generally be released to all plant breeders. The term basic genetic material refers to plant materials possessing one or more potentially desirable characters such as insect or disease resistant, climatic variations, improved yield and quality, etc., which, in the opinion of the Experiment Station directors and/or agency administrators, may be of value in plant breeding and, in their opinion, general release is in the best interests of U.S. agriculture and the state or agency research program.

Periodically, the originating station and/or agency should make available to the public a list of the germ plasm released for restricted use. If not formally published, the list should be available upon request.

Every effort should be made to insure that basic genetic materials are not monopolized by any interests. Furthermore, inbreds and other breeding materials should not be released for commercial use in foreign countries prior to their release in the U.S. Always, the original source of the breeding material should be acknowledged publicly.

The breeding of better varieties to reduce production hazards, to improve quality, and to increase efficiency is one of the important functions of the Stations and the Department. As problems arise which can be solved by crop breeding, it is obvious that these governmental agencies have an obligation to investigate them. Free interchange of a wide range of materials, specialized facilities, scientific competence in many disciplines, and the opportunity to test, observe, and to study reactions under a wide range of environmental conditions enhance the probability of success.

Experimental varieties and lines should be tested for yield, survival, disease and insect reaction, and other important characteristics in comparison with standard varieties, using techniques that assure valid measures of performance.

Crop varieties are not limited in adaptation by state or national boundaries. Interstate testing and interchange of materials should be encouraged. When appropriate, intercountry testing should also be encouraged. Regional testing facilitates more general use of widely adapted varieties. It also reduces time needed to provide reliable information on varietal adaptations.

New varieties of crops to be used for specialized industrial purposes should be tested for these uses to insure that they are satisfactory. The trade or industry using the crop should have opportunity to evaluate the new variety before distribution. We follow this practice in our Tobacco breeding work.

During testing and seed increase of experimental lines and new varieties, all reasonable precautions should be taken to protect the privileged status of this material and to prevent pirating and premature or unauthorized distribution.

Decisions on the release of new varieties should be made for each state by the appropriate agricultural agency of that state. It is recommended that in each state there be a policy committee or board of review charged with the responsibility of reviewing the proposal for the release of a new variety in that state. Appropriate information concerning characteristics, performance, area of adaptation, specific use of values, seed stocks, and proposed methods of increase and distribution should be presented to this committee as a basis for its decision.

When a variety has been tested on an interstate basis, opportunity should be given each state in the interstates program to consider whether the variety should be released in that state. Interested states should be permitted to release the variety simultaneously. If, for some reason, prior interstate testing was neglected or impossible, the state which may shortly release a new variety should offer to all interested states seed of the new variety for testing and increase. Nearby states may thus obtain information to answer questions from their farmers about the new variety.

When the development of a new variety is the result of cooperative effort by a state or states and a federal agency, consideration for release should be a joint responsibility of the agencies involved.

A new variety should not be released unless it is distincly superior to existing varieties in one or more characteristics important for the crop, and is at least satisfactory in other major requirements. A major single production hazard which a new variety can overcome, e.g., a highly destructive disease, may become the overriding consideration in releasing a variety. Varieties with a very limited range in adaptation should not be released unless performance in that limited range is outstandingly superior, or the variety possesses important use values not otherwise available.

A new variety should be given a permanent designation before it is released. The designation should be acceptable to the states participating in the release, but the originating station or agency has the final responsibility. When this designation is a name, this name should consist preferably of one word, the shorter the better.

The International Code of Nomenclature for Cultivated Plants provides guides for the naming of varieties. It is recommended that this source be consulted with respect to new variety names.

Under no circumstances should a variety be distributed under more than one name nor should the same name be used more than once in a given crop.

Once established, a legitimate varietal name should not be changed.

Names which are misleading or which are identical or similar to brand names or trademarks associated with agricultural products should be avoided.

New varieties of field crops registered by the Crop Science Society of America should be submitted for registration promptly following their release.

When it becomes evident that a new variety is sufficiently promising to merit consideration for release, breeder seed should be increased to the volume needed to produce and maintain required foundation seed. So long as a variety is retained on the recommended list of the originating station, that station should maintain a reasonable reserve of breeder seed, which will be used to replenish and restore foundation seed of the variety to desired genetic purity. When a variety is distributed in several states, oi when the originating station ceases to maintain breeder seed of a variety, a mutually satisfactory plan should be worked out among the interested stations regarding the maintenance of breeder seed. Interested states should be notified well in advance by the originating station when it plans to discontinue maintenance of breeder seed of a variety.

A sample of breeder or foundation seed of all newly-released varieties should be supplied to the National Seed Storage Laboratory, Fort Collins, Colo.

Foundation seed is of prime importance in the multiplication of a variety. It should be produced by those who have the experience, the facilities, and the skills to assure adequate supplies of pure seed. Foundation seed of publicly produced varieties should be increased under official guidance. Reserves of foundation seed should be maintained to assure a continuing supply in case of seed crop failure.

Distribution of foundation seed stocks may present interstate problems, particularly when a variety release is not simultaneous in all states. When foundation seed stocks are being distributed into another state where the variety is being distributed under allocation as a new release, the foundation seed should be offered through, or with the concurrence of, the official seed stocks or certifying agency in that state.

Foundation seed should be released in a manner that will be of the greatest benefit to farmers and the public in general. Foundation seed should not be used for speculative purposes. Within this context Foundation Seed programs should recognize the following basic principles:

1. All qualified seed growers and seedsmen should have an opportunity to obtain appropriate planting stocks at an equitable cost. Qualifications could form an exhaustive list; however, a few important ones are:

A. The Company should serve the state or region for which the variety has been developed.

B. The Company must be reputable.

C. The Company should have resources and technical know-how to do an efficient job of seed multiplication.

D. The Company should have an effective distribution system.

2. Limited release of foundation seed of a given variety is acceptable only in situations and only to the extent that general release to seed growers and seedsmen will not provide adequate seed of this variety on a continuing basis. Then, it is in the public interest to limit this release and I think makes good sense.

3. Appropriate planting stocks of varieties developed cooperatively with the agencies of the U. S. Department of Agriculture must be made available through or with the concurrence of the seed stocks or certifying agency of the cooperating state(s) at an equitable cost to all qualified seed growers and seedsmen, as appropriate. There shall be no monopoly in access to foundation seed of such varieties.

The National Foundation Seed Project founded in the Northeast (N.Y., Penn., etc.), was highly successful in allocating foundation seed to any seed producing state of varieties which were good seed producers and for which there was a widespread demand but it did not succeed with varieties that had serious seed yield problems or limited area of uses. Narragansett alfalfa is a good example. If it had not been for the activities of the Northeast Seed Development Corporation, an organization of seedsmen in the Northeast, organized to facilitate multiplication of forage varieties used in the Northeast, Narragansett alfalfa would have folded and faded away. Various schemes to meet needs of seedsmen and farmers have been developed; however, before a limited release should be made, it must be in the public interest and not provide any organization a monopoly.

Seed producers, distributors, and farmers should be informed as fully as possible of the values and the adaptation of new varieties in comparison with varieties already grown.

Pertinent information as to the basic facts of origin and characteristics, and data justifying the increase and release of a new variety, shall be prepared by the fostering state(s) and/or agency(ies) and provided to other interested states or agencies. The information used in deciding upon release of a new variety should be used in presenting the case to seed producers, distributors, and farmers. Participating states should use this material, supported or modified by their own information, in state publicity. Publicity intended for national or regional periodicals should include information on the regional adaptation of the variety. A uniform date for the release of initial publicity should be agreed upon by the interested states and, when appropriate, by cooperating federal agencies.

Seed production and demand must be developed together insofar as possible. A seed supply and no demand, or demand and no seed supply, often result in confusion and the failure of a variety to make its maximum contribution to agriculture. An educational program setting forth the superior characteristics, region of adaptation, and any special limitations should be coordinated with seed supply.

In closing, let me say that varieties are considered for release after adequate testing to ascertain, within reasonable confidence limits, the performance that may be expected under specified environmental conditions - (yield, quality, and persistence as affected by disease, insects, climate, management, etc.). -- We need legumes, alfalfa and clovers resistant to the alfalfa weevil.

I THANK YOU!

<u>Role of Public and Private Plant Breeders</u> - I. J. Johnson

Ever since the dawn of civilization when primitive man gathered seeds either to serve as food, for growing another crop or as a storage reserve against possible famine there has been a need for plant improvement. The "art" of plant breeding grew up with the development of man and his agriculture. Through untold centuries of time there has thus come into existence a vast array of plant materials -- much of it the product of evolution and some of it directed by man himself. Unfortunately, many of the native species and their ecotypes may have been developed for naught. Seldom, if ever, have the products from evolutionary channels been compatible with the needs of present-day complex agriculture or the exacting needs of the consumer. The wild progenitors of cotton would create few problems in overproduction. Anyone visiting a fresh fruit and vegetable market would hardly wish to substitute the highly developed products for the inferior quality of their ancestors. Nurseries are filled with brand new varieties and kinds of ornamental plants. From Azeleas to Zinnias today's products are tailor-made to fill a specific demand. But, most important, these plant products <u>are</u> in the market place because there is a demand and need for them in our present-day society. Often the need may be short-lived in our dynamic agriculture.

The methods used to achieve a desired goal also have undergone change, perhaps even more dynamic and certainly of shorter duration than the biological processes by which species were evolved. It is fruitless to argue if plant breeding had its beginning in the pre-Darwinian era or whether it began after the establishment of experiment stations under the Hatch Act. But all can agree that it surely became "of age" in the post-Mendelian period coincident with the expansion of Land Grant Colleges and Agricultural Experiment Stations, with the growth and development of crop production to meet the demands of a highly competitive market and with the expansion of agriculture as a complex industry.

One of the directives to experiment stations under the original Hatch Act was concerned with testing new crops and with developing new varieties in field and horticultural plants. This was not a surprising objective because it was evident early in the history of American agriculture that existing varieties, largely introduced from abroad, could not be expected to fully meet the needs for ever-expanding uses of feed, fiber, and food crops. It also was not surprising that this directive became activated into a large number of research projects at nearly every experiment station. In most Agronomy and Crops Departments the research budget in crop breeding exceeded the research budgets for all other phases of crops investigations. The number of graduate students in crop breeding and genetics also exceeded those in other areas of crop science. In retrospect, the period since the early 1920's has been the era of the public plant breeders.

Private research in plant improvement, in the beginning, largely was limited to the development of ornamental plants. This was so because experiment station directors could hardly justify the diversion of limited funds from strictly agricultural project to those that also served urban populations. But with the development of hybrid corn it soon became evident to private plant breeders that the opportunities in field and horticultural crops were as many and as promising as those in horticultural crops. Plant breeding by industry in the Southern States, with cotton as the key crop, set a pattern for breeders in other areas. The period beginning in the early 1930's to the present time also can be described as the era of the private plant breeder. But it appears that the era of private plant breeding is somewhat different in its development than the era which began somewhat earlier at experiment stations. Industry programs are now expanding rapidly on a widening diversity of field, horticultural and ornamental crops. A major difference is that a single discovery can and does result in rapid response by the industry, as exemplified by cytoplasmic male sterility in sorghum and wheat.

From the foregoing, it is evident that American agriculture now enjoys the benefits of two distinct programs each designed to supply it with improved crop varieties--one paid for by public funds as conceived in the era when experiment stations were becoming established and the other by private funds. This is a unique situation. It is not often that the farmer has two research programs working in his behalf. But it also is evident that in the best interests of utilizing professional manpower and in the proper expenditure of funds that perhaps overabundance of effort should be brought more nearly in line with needs. This is not a new or unique thought but one that has been under consideration for some time in certain crop plants. For example, in

hybrid corn and grain sorghum, in cotton and in many vegetable crops by far the greatest percentage of seed planted by growers is with varieties developed in private breeding programs. But for other crops, such as the cereal grains, soybeans, flax and most species of forage plants the commercial varieties largely have come from public research programs. As previously stated, a single discovery as in hybrid wheat and hybrid barley can rapidly alter the relative emphasis that industry may wish to place on its research expenditures for a given crop.

In those crops in which industry has made its greatest contribution there has been, over the years, a gradual transition in the type of research effort given to these crops by public research agencies. There also has been a very wholesome and open exchange of research information between public and private plant breeders. The corn breeder at an experiment station -- to cite one example -- is today generally more concerned with problems of gene action as related to heterosis than with the development of a hybrid for distribution to farmers. He is more concerned with basic research in genetics, cytology, physiology, pathology, entomology and with chemical constituents than with the strictly applied phases that have as their objective immediate economic returns rather than long-range benefits that come from pioneering into basic sciences. And, of equal importance, the corn research worker at public institutions has developed genetic stocks from his research and has made such stocks available to the private breeding industry.

This transition in corn breeding at experiment stations from major emphasis on applied to major emphasis on basic research did not come rapidly. It came, perhaps, only after the industry had fully demonstrated to the farmer that in the competitive enterprise system under which it must operate that its research products did indeed meet the needs of the consuming public. And the transition did not come rapidly because many stations had large applied breeding programs in operation for which good judgment dictated that prior investments in time and capital had to be carried to completion. And, finally, the interests and capabilities of staff often could not be rapidly diverted from applied to basic research. Another important factor in the transition in emphasis from applied to basic research in corn was related to the seed industry itself, namely, those firms that were large enough to support their own programs and those whose smaller volume of sales required dependence upon public agencies to develop hybrids for their seed production and sales.

I have chosen to recite the "case history" of corn breeding as an example of the role of industry in plant breeding because in reality all of the problems that were initially present and the solutions for them are inherent in any other crop that could be cited, namely,

1. The need for a mechanism by which the industry investment in breeding may be protected through genetic or other methods of insuring breeder rights.

2. A market for the product of sufficient magnitude to justify expenditure of funds by private research.

3. A wholesome cooperative relationship between public and private plant breeders operating through joint research -- education conferences.

4. A recognition that both public and private plant breeders have equally important roles to play in serving the best interests of the farmer and in the expenditure of manpower resources and funds.

5. A recognition that the products of basic and pioneering research can be converted into useful products most rapidly through the "many hands" available in industry.

The above points are by no means inclusive nor do they even begin to cover the total subject of the Role of Public and Private Plant Breeders.

It is appropriate to ask, but impossible for any person to answer for the industry as a whole, when private and public plant breeding should not overlap. Perhaps we can agree that in the future development of our profession it generally will be more effective for public research agencies to move forward with greater emphasis on basic research. Such a move will most effectively utilize the combined skills represented by biological sciences on the staffs of Land Grant Colleges and from it to make new knowledge available for industrial application. This is the pattern of development that has become established in chemistry, physics and many other sciences that ultimately serve mankind through their contributions to knowledge.

Private plant breeding programs must recognize and discharge their responsibility to continually create a favorable environment for support and recognition of accomplishments in basic research. Fortunately, the public at large is each year becoming more aware of the need for basic research as the driving force for progress. Perhaps the time is not too far off when accomplishment and rewards in terms of advancement in agricultural research at experiment stations will be determined more by the number and quality of research contributions than by the number and performance of the varieties released.

Although private research in plant breeding at its present stage of development may be dependent largely upon public programs for much of its basic knowledge, it should not be inferred that private research itself does not develop new concepts. A recent survey by the National Council of Commercial Plant Breeders has shown that the number and level of training by industry plant breeders represents a considerable manpower resource, trained to the same high degree of proficiency as those on university staffs.

Although idealistically one might wish to conclude that industry should engage in the applied and experiment stations in basic research in plant breeding, realistically this cannot be so. There are many crops in which the seed needs for improved varieties is so small that industry cannot afford to undertake the cost of their development. Perhaps the experiment stations also might have difficulty in justifying research of such crops. A possible solution to these problems both to industry and experiment stations is the development of contracts or special grants between grower and research agencies to solve these problems as they arise.

Training of graduate students for ultimate careers in plant breeding is one field of endeavor in which universities stand alone. But one should not overlook the opportunities for "in-job" training that become possible in industry research programs. Graduate students who desire to establish a career in private research can gain worthwhile experience and insight from a period of study in private firms.

To conclude this presentation your speaker hopes he has made a few points reasonably clear. It is evident that private plant breeding is becoming an expanding force in our agricultural economy. This is good for agriculture because competition for markets requires the best possible product. The farmer cannot help but gain when several firms seek to expand sales by developing superior products.

As private plant breeding expands the experiment station scientist has new opportunities available to him in basic research to most effectively utilize his training and facilities. This trend is a part of the present-day surge to seek new horizons in science. Private research must recognize its responsibility to create a favorable environment for basic research by public recognition of its value to the well-being of agriculture.

Basic research often produces two kinds of products -- new knowledge and genetic stocks used by the scientist to develop or test the validity of new biological principles. Although many experiment stations have developed well organized procedures for release of new crop varieties, very few have developed policies and procedures for multiplication and distribution of genetic stocks. These by-products of basic research may have a great deal of usefulness in agriculture as genes to overcome defects in present varieties. I am hopeful that the present emphasis given to this subject by committees in scientific societies may result in actions mutually beneficial to all.

In this period of agricultural development in which increasing demands are being made by the public to critically examine new goals and objectives, it will be most appropriate for both public and private research administrators to jointly seek to find ways by which our combined resources can be used to fulfill a common objective. There is no need to excessively duplicate efforts nor does it make good sense to overlook areas of responsibility that each assumes the other is doing. To me these are the real challenges that lie ahead, namely, an effective teamwork between public and private research agencies to most effectively utilize this important scientific manpower resource.

Outlook for Future Varieties - Public and Private - C. H. Hanson

Predictions require speculation. In order to hold speculation to a minimum, I shall enumerate some established facts on forage breeding, review certain trends that are becoming apparent, and attempt to project these trends into the future.

First, some basic facts about forage breeding:

1. Public and private agencies are engaged in breeding forage crops.

2. There are about 125 forage species of economic importance.

3. Genetically, forage plants are very complex - largely self-incompatible, higher polyploids, and either wind or insect pollinated.

4. Forage and seed production often occur in different areas.

5. Objectives are complex, and they include developing resistance to diseases, nematodes, and insects, high nutritional value, and high productivity in forage and seed producing areas. Cost of attaining many objectives cannot be recovered in sale of seed.

6. Evaluation of new lines is laborious and expensive.

7. Present effort on breeding forages is insufficient to keep pace with improvements that are critically needed and which are being made in other crops.

One conclusion readily apparent from the foregoing is that there is a job for every forage breeder, and that breeding efforts in public and private agencies should complement each other if maximum progress is to be made from available funds and facilities.

## Trends in Alfalfa Breeding

I shall use alfalfa for discussing trends in forage breeding, since I have been closely associated with this crop.

### The Joint Alfalfa Work Conference

By the late fifties, industry was beginning to invest considerable sums of money in alfalfa breeding. In order to enhance continued good cooperation among public and private plant breeding research groups, an interested group met twice in 1960 to discuss problems of common concern. These matters pertained to publicly and privately developed varieties of alfalfa, and to interrelated problems of special concern to seedsmen and public institutions. That group later became known as the Joint Alfalfa Work Conference (JAWC). Participants at the Conference represented the Alfalfa Improvement Conferences, American Seed Trade Association, International Crop Improvement Association, Agricultural Research Service, and the State Experiment Station Committee on Organization and Policy (Seed Policy Subcommittee). The conferees delineated problems and made recommendations on

release and exchange of germplasm, variety testing, and seed certification.

We will not have time today to consider the entire report of the JAWC, but I shall summarize or quote some of the principal conclusions.

I. Release and Exchange of Alfalfa Germplasm:

The timely interchange of seed and other propagating materials of both released and unreleased stocks can make a significant contribution to progress in genetics and plant breeding. Historically, this distribution, which is a form of communication between scientists, was almost entirely between workers in the United States Department of Agriculture and the State Agricultural Experiment Stations. Broad undercurrents of change in recent years have introduced at least two new elements which today play an increasingly important role. These elements are the development and growth of plant breeding as a commercial enterprise, and the increasing complexity and ingenuity found in the application of genetic principles and plant breeding techniques to the development of new varieties.

All breeders, public or private, should give full and appropriate credit of the use of any materials released to him and recognize that this should be done in a manner agreeable to the parties involved.

All breeders, public or private, are encouraged to submit all new varieties to the Variety Registration Committee of Crop Science Society of America.

II. Alfalfa Variety Testing:

The report suggested a procedure for alfalfa performance trials. This procedure had as its primary objective the testing by experiment stations of privately developed strains or varieties of alfalfa, mostly in the seed consuming area. It recognized that industry also may have facilities available and wish to cooperate in evaluating varieties and strains of alfalfa for public institutions.

III. Certification of Alfalfa Varieties:

Seed certification provides a valuable service to seedsmen and farmers by making available high quality seeds and propagating materials of varieties so grown and distributed as to insure varietal identity.

The Conference established a common set of rules and procedures applicable for certification of varieties from public and private agencies alike. It recommended establishment of a five-man National Certified Alfalfa Variety Review

Board consisting of representatives from public and private agencies. The functions of the Board were to review and evaluate the information presented by an alfalfa breeder in terms of criteria set forth in seed certification standards and report its findings to all certifying agencies. The Board, established in 1961, reviews variety applications from public and private agencies.

Germplasm Release.

Increasing attention is being given to development and official release of improved germplasm. In the last 5 years, the Agricultural Research Service in cooperation with State Experiment Stations has formally made nine alfalfa germplasm releases. Six of them were improved populations possessing a broad genetic base and resistance to specific diseases and insect pests. It is anticipated that they will be used by recipients as source material for future varieties. In this connection a committee of the Crop Science Society is considering a proposal to register elite releases much as it registers varieties.

Work Conferences.

A national alfalfa work conference is held in even-numbered years; regional conferences are held in alternating years. These conferences were first held to meet the needs of alfalfa workers in State and Federal agencies. Today, alfalfa specialists from industry regularly attend the conferences and participate in programs. These conferences serve as a medium through which new information is exchanged.

## Looking to the Future

In my crystal ball, forage breeding affords challenging opportunities for increasing world food production. The field is also challenging to basic science. There is a growing need for improved forage varieties to keep pace with the need for better forage crops and with other segments of agriculture. The yield and digestibility of forage varieties need to be increased. There is a growing need for varieties with special uses. No longer can we be satisfied with expressing varietal performance as yield of dry matter alone. Forages for the next decade should also possess multiple resistance to diseases, nematodes, and insects if they are to be competitive. The complexity of the job is increasing. The cost of attaining many objectives in forage crops is greater than the recoverable costs from merchandising seed of the improved variety. The need for improved varieties is too great for a forage breeder in a public agency to "shirk" responsibilities to agriculture.

At the same time, public workers are becoming aware of increasing contributions that private industry is making to the development and release of new varieties. They are becoming aware of the increasing responsibility of public agencies in the development of improved breeding procedures and basic germ plasm stocks, and of the tremendous need for development of basic information on which continued breeding progress depends. Public breeders should assume leadership in releasing breeding

material to fellow workers in public and private agencies. Under this program superior clones or lines (outstanding with respect to one or more characteristics, e.g., male sterility, resistance to disease and insect pests, etc.) are formally released. This procedure provides recognition to originating agencies for expenditures involved in developing breeding stocks and avoids expense of distributing and evaluating materials of questionable merit.

The ultimate value of certain breeding stocks can only be evaluated when they are incorporated into improved varieties. Therefore, public agencies will continue to release varieties, if by so doing the new variety will aid in demonstrating either the value of new germ plasm or utility of a new breeding system or method. Varieties should be released when it can be shown that they will meet identifiable local or regional needs. Partial dependence on industry for varietal development and variety testing will permit workers in public agencies to devote more effort to the isolation of superior germ plasm and to the expansion of basic investigations.

We need to continue to probe into additional ways by which efforts of breeders in private and public agencies may complement each other, and I have enumerated below some viewpoints which appear pertinent.

1. A new variety should not be released until its merit has been demonstrated.

2. The number of seed generations and areas of seed increase are as important as the name itself for describing a forage variety. This is true because of the ease in which genetic changes can occur during seed multiplication of most forage species. Stability can be obtained by procedures such as those used by the International Crop Improvement Association.

3. All qualified seed growers and seedsmen should have an opportunity to obtain appropriate planting stocks of public varieties at an equitable cost.

4. Respect for the variety label should prevail. Forms of merchandising which confuse or blur variety identification neither help the farming public nor contribute to good working relationships among cooperating agencies.

5. Strong breeding and genetic programs on forages in public agencies help industry as well as the farming public.

6. There are those that feel that some form of protection is needed by the owner of a crop variety to assure an adequate return for the research investment. By protection is meant the assurance that the owner has exclusive control over increased distribution and merchandising of his variety. Several kinds of protection have been debated.

(a) Breeders' rights legislation has been studied at great length. Some form of registration of varieties is usually considered essential for any regulatory protection in order to designate the product to be protected. It has been pointed out, however, that a strongly enforced program of breeders' rights might create the necessity of providing such protection to publicly developed varieties as well as private. If the monetary advantage of such protection is large, one might see trends in public institutions to develop protection for their varieties in order to gain financial income from them. If that happens, one can visualize a sharp restriction on the exchange of germ plasm. Such restriction of free interchange among plant breeders would have a deleterious effect on breeding progress.

(b) Seed certification may also provide protection for a variety. Protection is afforded if the position is taken that only certified seed is truly representative of the variety and noncertified seed is not genuine.

(c) Limitations of generations for which a variety name is valid could, in itself, constitute protection.

(d) Of course, if biological protection is built into a crop in which first generation hybrids can be marketed, the originator can control the variety merely by controlling the basic lines.

A parting thought on this matter is that there are numerous opportunities for every plant breeder interested in forage improvement. We need to continue striving, however, to develop working relationships in which efforts of breeders in public and private agencies will complement each other. Finally, all efforts fail unless there is a mutual feeling of trust and respect.

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